ANGULARLY ADJUSTABLE POST MOUNT

Technical Field

[0001] The present invention relates in general to mounting apparatus for posts and in particular to angularly adjustable mounting apparatus for markers, sign posts, and the like.

Background

[0002] A variety of road signs, markers, and traffic delineators include a post or other support that is set in a substructure such as the ground. For example, marker posts are often made from a domed, round cedar post approximately 4 to 6 inches in diameter that is painted, equipped with reflectors and set in a post hole. While the post materials are relatively inexpensive, installation is labor intensive and time consuming. To set a marker post properly, the post hole must be dug to a depth of approximately 24 to 30 inches and the post must be held in alignment while the hole is carefully backfilled with sand, gravel or cement, so that the post is tight, upright and secure.

[0003] Unfortunately, no amount of care in setting a post will prevent it from becoming misalignment over time due to shifting ground conditions and normal freeze / thaw cycles, not to mention misalignment or destruction that can result from vehicle impacts. Setting the post in cement may retard the natural processes somewhat, but eventually nature (and human nature) will prevail and the post, together with the cement, will shift in the ground and become crooked, or be sheared off the mount by an errant driver, sending the post dangerously into the air and leaving a stub securely and permanently embedded in cement. Even costly spring-type mountings and posts which

are designed to survive being run over, will, at best, only return a post or marker to the position it was in before being hit, a position that inevitably will shift out of alignment over time.

[0004] Resetting or replacing a post is a time consuming project and realignment can be as time-consuming as setting a new post. It generally involves excavating around the post and/or the post mount until enough earth is removed to allow the post to be moved followed by careful backfilling to ensure the post or post mount is securely set in proper alignment. This process may need to be repeated every few years, depending on the environment. Moreover, a significant number of posts are struck or run over and require replacement. Some must be maintained, repaired or replaced for safety reasons as soon as possible. If the ground is frozen hard, a fire may need to be built and maintained over the excavation site until the ground has been thawed sufficiently to begin digging. In times of shrinking budgets, it becomes increasingly difficult to keep up with the labor intensive, costly, and never ending process of post realignment, and general maintenance related to appearance and or replacement.

[0005] What is needed is a simple, safe, inexpensive, low maintenance apparatus for mounting and anchoring a post that will enable the post to be easily realigned or replaced without costly and time consuming excavation. The apparatus should stand up well to the elements, be easy to install and be capable of mounting an inexpensive and easily replaceable post that is also durable and pleasing in appearance. It would also be desirable that the post have the capability of breaking away from the mounting if it is hit by a vehicle without causing significant damage to the mounting or to the vehicle.

Summary

[0006] In general, in one aspect, a mounting apparatus for a post includes a stationary portion having an attachment rod secured to a substructure and extending from the substructure in a direction defining a first axis, a post base positioned above the stationary portion that includes a post mounting surface and a curved downwardly facing bottom surface, the curved downwardly facing bottom surface having a slotted aperture through which the attachment rod extends, a lower bearing positioned beneath the post base, the lower bearing having a curved upwardly facing surface substantially corresponding in curvature to the curved downwardly facing bottom surface of the post base and in slidable engagement therewith, and providing a central aperture through which the attachment rod extends, and means to releasably secure the post base to the stationary portion such that the post base may be rotated about the first axis and angularly offset therefrom to enable a mounted post to be angularly aligned and then secured in place.

[0007] In general, in another aspect, the post base is configured to mount a post that will break away from the mount in response to the force of a vehicle impact. In general, in another aspect the post base is adapted to break away from the attachment rod in response to the force of a direct vehicle impact to the post base.

[0008] In general, in another aspect, a method for mounting a post includes providing an attachment rod secured to a substructure on one end, the other end extending away from the substructure in a direction defining a first axis, mounting a bearing to the substructure, the bearing having an upwardly facing semispherical curved surface concentric about the first axis and an axial hole to admit the attachment rod, mounting a

post to a post base, the post base comprising a downwardly facing semispherical surface corresponding in curvature to the upwardly facing curved surface of the bearing, and comprising a slot aperture therethrough, the slot extending from the center in a radially outward direction, mounting the post base over the bearing by passing the attachment rod through the slot aperture of the post base, angularly adjusting the attitude of the post /post base to compensate for any vertical misalignment in the first axis by pivoting the post base about the first axis and positioning the attachment rod in the slot aperture to offset the center of the post base from the first axis until the post is vertical; and securing the post in position by engaging a fastener to the attachment rod and tightening the fastener until the post is locked in position.

Brief Description of the Drawings

[0009] Fig. 1 shows exploded side sectional view of an embodiment of an apparatus according to the present invention.

[0010] Fig. 2 shows an exploded plan view of an embodiment of an apparatus according to the present invention.

[0011] Fig. 3 shows a side sectional view of an embodiment of a post base according to the present invention.

[0012] Fig. 4 shows a plan view of an embodiment of a post base according to the present invention.

[0013] Figs. 5A, 5B and 5C show vertical cross sections of an embodiment of a mounting apparatus according to the present invention in three different orientations of the stationary portion.

[0014] Fig. 6 shows a side sectional partially exploded view of one alternative embodiment of an apparatus according to the present invention.

[0015] Fig. 7 shows a side sectional partially exploded view of another alternative embodiment of an apparatus according to the present invention.

Detailed Description

[0016] In the following detailed description, reference is made to the accompanying drawings that form a part hereof, and in which are shown by way of illustration specific embodiments in which the invention, as claimed, may be practiced. The invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. As will be appreciated by those of skill in the art, the present invention may be embodied in methods and devices.

[0017] Referring now to the drawings, wherein like numbered elements correspond to like elements throughout, the present invention includes an adjustable mounting apparatus for a post designated generally as post mount 100. Post mount 100 may be used for mounting and anchoring a variety of posts, such as marker posts, delineators, channelizers, signposts, mailbox posts, and the like, and may be installed on roadsides, medians, boulevards, traffic islands, as well as in parking lots, malls, drive through lanes, airport runways and taxiways, railroad right of ways, bike trails, athletic fields, and

generally, wherever posts, markers, delineators and informational or warning signs are used. A post that is mounted in accordance with the present invention is durable, safe, simple to repair, pleasing in appearance and can be realigned in a matter of minutes without digging up or resetting the post or post mounting in the ground. Post mounts according to embodiments of the present invention are designed to enable rapid vertical realignment of a post and excellent stability. Post mounts according to embodiments of the present invention are designed to enable mounting of a post that will break away cleanly from the mounting when it is impacted by the force of a moving vehicle or other object so as to reduce or avoid damage to the mounting and to the vehicle or object. Post mounts according to embodiments of the present invention are designed to significantly reduce the amount of time required to replace or maintain a broken, misaligned or unsightly post.

[0018] Fig. 1 shows a side sectional exploded diagram of a post mount 100 with an exemplary post 115 mounted thereto in accordance with a preferred embodiment of the present invention. Post mount 100 includes a stationary portion 105 that provides an attachment rod 104 secured to a substructure such as the ground, which extends away from the substructure in a direction defining a first axis 121, and post base 109 positioned above the stationary portion on which a post can be mounted. The post base109 includes a post mounting surface and a curved downwardly facing bottom surface that provides a slotted aperture 111 through which the attachment rod 104 extends. A lower bearing 106 is positioned beneath the post base 109 and provides a curved upper surface 108 corresponding to the bottom curved surface 110 of the post base. A center aperture 128 extends through lower bearing 106 and provides an opening through which the

attachment rod 104 passes. Curved surface 108 lies in cooperating engagement with the bottom surface of post base 109 so as to form a joint 113 that enables angular adjustment of the post base 109 with respect to the first axis 121 within a predetermined range to offset vertical misalignment of the stationary potion 105 and 360 degree pivotable adjustment about the first axis 121. After any necessary adjustment has been made, the joint 113 is releasably locked into position and can be realigned as may be necessary from time to time. Mount 100 also provides a post and/or post mount break away capability in response to the force of a vehicle impact.

[0019] In the embodiment illustrated in Fig. 1, attachment rod 104 is embedded in an anchor or footing 103 that is securely set in the ground or other substructure. Anchor 103 is constructed by filling a conventional posthole with a ready mix concrete or anchoring cement approximately to ground level and smoothing the surface to provide a mounting surface 102 that is substantially level and, perpendicular to first axis 121, which should be substantially vertical, at least initially. Mounting surface 102 should provide an area that is slightly larger than the cross sectional area of the post to be mounted. In other embodiments, attachment rod 104 can be embedded in an existing stationary structure such as a concrete slab.

[0020] In the embodiments illustrated, attachment rod 104 is formed from a 9/16 inch in diameter threaded steel bolt between 6-15 inches in length embedded in an upright position in the cement forming anchor 103. The threaded bolt extends approximately 2-3 inches above mounting surface 102 to enable securing the post base 109 with a fastener 114 such as a nut above a washer 134.

[0021] In some embodiments it may be desirable to use a threaded attachment rod with a fixed head that is inserted into a threaded sleeve embedded in stationary structure 103. Care should be taken in assembling and aligning mounts according to this embodiment to ensure that attachment rod is properly sealed into the stationary structure to avoid accumulation of moisture in the sleeve which could cause damage to the structure from freeze/ thaw cycles or corrosion.

[0022] Various other alternative mounting arrangements are possible. For example, attachment rod 104 may be formed from a stake or a screw that is driven or embedded directly in the ground and can be provided with a collar or flange to a form mounting surface 102. One or more claws or outward projections may also be added to the embedded portion of attachment rod 104 to hold it more securely in place. In still other embodiments, attachment rod 104 may include a mounting plate for securing to existing structures by rivets, bolts, screws or an adhesive or other fastener. In still other embodiments, attachment rod 104 may provide a conduit for electrical wires and the like. The attachment rod 104, fastener 114 and washer 134 are preferably formed from corrosion resistant steel or steel coated with a corrosion resistant surface material such as zinc, cadmium, or nickel plating, for example.

[0023] Lower bearing 106 fits beneath post base 109 and provides a surface area that is substantially coextensive with the surface area of the curved downwardly facing bottom surface of post base 109. In the embodiments illustrated in Figs. 1-5 and 7, lower bearing 106 is disc shaped to correspond to the round horizontal cross section of post base 109. Lower bearing 106 has a flat lower surface 107, a convex upper surface 108 and a center aperture 128 of a sufficient bore to slide over the attachment rod 104. Flat

lower surface 107 rests on horizontal mounting surface 102. The convex surface 108 of lower bearing 106 provides the lower bearing surface of an joint 113 formed by the engagement of convex surface 108 and a corresponding concave surface 110 on the bottom of post base 109.

[0024] Post base 109 is generally cup shaped and, as illustrated, has a round cross-section for mounting a round tubular post 115. The outer diameter 118 of post base 109 is dimensioned to snugly engage the inside wall 135 of post 115 so that the post can be mounted over the base. Referring to Figs. 3 and 4, outer diameter 118 is 4.63 inches and closely corresponds to the inside diameter of tubing used for the post, which, in this example, is formed from a 5 inch outer diameter rigid white PVC irrigation pipe with a 0.175 inch thick sidewall. Post base 109 is open at the top and partially closed at the bottom. While the height of post base 109 will generally depend on the type of post to be mounted, the base should be kept low in profile to avoid direct impact with the bumper or undercarriage of a vehicle that strikes the post. At the same time, as will be explained below, post base 109 should provide a sufficient external surface area to securely mount the post. In the illustrated embodiments, post base 109 is about 4 inches tall.

[0025] The joint 113 formed by the engagement of concave surface 110 and corresponding convex surface 108 of lower bearing 106 enables the post to be angularly adjusted. Concave surface 110 and convex surface 108 preferably form semispherical curved surfaces, i.e., surfaces that provide substantially spherical symmetry about a central axis. In general, the radius of curvature 120 of the curved surfaces 110 and 108 should be as large as possible to distribute the load over the largest possible area and to increase joint stability. For example, in the embodiment of Fig. 3, the radius of curvature

120 is 12 inches so that the semispherical concave surface 110 is substantially coextensive with the bottom 117 of the cup shaped post base 109. While the bearing surfaces of joint 113 may take the shape of a variety of rounded surfaces, such as spheroidal, ellipsoidal or paraboloidal, surfaces having a substantially constant curvature throughout, such as spherical or semispherical, are generally preferred for their smooth positioning, good stability and even load distribution in a variety of angular and rotational orientations.

[0026] A transverse slot opening 111 is provided in the bottom 117 of post base 109. The width 124 of slot opening 111 is dimensioned to slidingly accommodate the attachment rod 104, which is 9/16 inch in diameter in this example. In the illustrated preferred embodiments, slot 111 is about 3.0 inches in length and extends for 1.5 inches on either side of the vertical axis or center of the post base 109 (shown in alignment with first axis 121 in Figs. 1-4). The range of motion of joint 113 is proportional to the ratio of the distance attachment rod 104 can be moved in the slot 111 away from the vertical axis of the post base 109 to the radius of curvature 120. For example, in the illustrated embodiments radius of curvature 120 is 12 inches. Slot 111 allows a 9/16 inch in diameter attachment rod 104 to be displaced from the center by a distance of about 1.25 inches, which provides an angular offset up to approximately 6 degrees. The angular offset can be aligned in any direction by pivoting the post base 109 around first axis 121. In the preferred embodiment slot 111 is centered lengthwise about the vertical axis of the post base to facilitate adjustments.

[0027] To illustrate the operation of joint 113, Figs. 5A, 5B, and 5C show vertical cross sections of mount 100 in three orientations of the stationary portion 105. In Fig. 5A

the axis 121 defined by attachment rod 113 of post mount 100 is aligned with the Z axis (i.e., vertical) and both concave and convex surfaces of joint 113 are concentric. Thus, no offset of adjustable portion 112 is needed. Fig. 5B shows a post mount 100 in which the longitudinal axis 121 of attachment rod 113 has tilted to the right, resulting, for example, from shifting ground conditions around stationary portion 105. To compensate for this angular misalignment to the right, post base 109 is repositioned on the convex surface 108 to the left by sliding attachment rod 104 in slot 111 to the right. Similarly, Fig. 5C illustrates a post mount 100 in which the longitudinal axis 121 of attachment rod 113 has tilted to the left. To compensate for misalignment to the left, post base 109 is repositioned on the convex surface 108 to the right by sliding attachment rod 104 in slot 111 to the left. While left and right offsets have been illustrated, the bearing surfaces of joint 113 can be used to compensate for angular misalignment in any direction by rotating the post base 109 about the axis 121 until the slot 111 is oriented opposite to the direction in which the stationary portion 105 is tilted, and then sliding attachment rod 104 in slot 111 until the post base 109 has been repositioned to compensate for the tilt.

[0028] In the preferred embodiment, lower bearing 106 and post base 109 are made from gray cast iron. Gray iron, in particular, is, strong, relatively inexpensive, and will stand up well to the elements. At the same time, a gray iron casting can be designed to break or shatter in response to a predetermined impact force. Additionally, cast iron naturally provides a roughened, textured surface that substantially increases the friction between adjacent surfaces. Cast iron bearing surfaces for joint 113 will reduces the amount of torque needed to lock the mount in position and also reduce the static force on attachment rod 104 when the mount is locked in position. To facilitate casting, the inner

side wall of post base 109 is angled inwardly toward the bottom tapering from a diameter 122 of 4.04 inches at the top to a diameter 123 of 3.74 inches at the bottom.

[0029] In many embodiments, post 115 will be selected from material that will break away upon a predetermined force of impact with the post and may need to be replaced from time to time. However, the materials selected for post mount 100 will generally be more durable and the post mount will be dimensioned to provide a very low profile so as to avoid direct impact with the bumper or undercarriage of a vehicle that strikes the post. Some vehicles such as a truck with a lowered snow plow will have little, if any, ground clearance and may strike even a low profile post base 109. A low profile post base 109 of gray iron manufacture and dimensioned as illustrated in the drawings is designed to break away from the mount without damaging the attachment rod after being struck by a snow plow, for example.

[0030] Post 115 is preferably made from a plastic pipe material such as poly(vinyl chloride) (PVC) or high-density polyethylene (HDPE) that is U.V. stabilized and has good mechanical strength and rigidity to withstand prolonged exposure to the elements but will bend or break away in response to a predetermined transverse force, such as the impact of a motor vehicle. The plastic pipe material is preferably of a type that can be heat expanded with a low temperature portable heat source such as a heat gun or propane torch so that post installation and replacement can be performed accomplished with a minimum of effort. While the post 115 and post base 109 may in some embodiments be dimensioned so that the post 115 fits inside the post base 109, mounting the post 115 over the post base 109 is generally preferred as it will enclose the post base and protect it from elements, improve the appearance, and may reduce damage to vehicles since there are no

external metal parts. In particular, mounting the post over the base will shield the interfaces between the post and the base and thus reduce freeze-thaw deterioration and damage from chemical deicers.

[0031] It will be appreciated that embodiments of the present invention can be manufactured in a variety of ways, and from a wide variety of materials. In some embodiments, post base 109, lower bearing 106 and post 115 or 715 can be of an inexpensive, molded manufacture, utilizing widely available plastic materials such as nylon, PVC or polyethylene. Such plastic parts may be manufactured in an injection molding or an extrusion process. Other plastic molding techniques, such as, for example, casting and compression molding, which are familiar to persons skilled in the art, may also be employed. In some embodiments of the present invention two or more components may be unitary in construction. For example, a post base and post may be integrated into a single molded or extruded part. In the embodiment shown in Fig. 7, a tubular post 715 of unitary construction includes a curved bottom surface 710 corresponding to the curved upper surface of a bearing 106 that rests on a stationary structure 103 where the post is to be mounted. The post 715 may also be constructed of separate parts that are bonded, welded or mechanically adhered together.

[0032] In various alternative embodiments, lower bearing 106 and anchor 103 may be formed integrally. Alternatively, components may be separately manufactured and assembled into a complete device by adhesives or by mechanical means, which will be readily apparent to those knowledgeable in the art of the material of fabrication.

[0033] Installation of a preferred embodiment of an apparatus 100 according to the present invention will now be described. Stationary portion 105 is anchored by boring a

standard diameter post hole in the ground to a sufficient depth. Where frost is a concern, the post hole should be between 40-48 inches deep. Where frost is not likely to be a problem a shallower hole may be acceptable, depending on soil conditions. Next, anchor 103 is formed by filling the hole to ground level with anchoring cement or the like. While the hole is being filled an 8 to 12 inch galvanized steel threaded bolt or shaft is partially embedded on end at the center of the anchor 103 leaving a stub of about 2-4 inches protruding from the surface to form attachment rod 104. The anchoring cement should be smoothed to provide a reasonably flat mounting surface 102 and to eliminate any indentations or gaps where water might collect, freeze and cause damage to the mount. Care should be exercised initially to ensure that attachment rod 104 remains in a vertical position while the concrete is allowed to set. In other embodiments of the invention attachment rod 104 may be drilled or otherwise embedded into a preexisting substructure such as a concrete pad or stone, or may be screwed into a threaded sleeve that has been embedded in the substructure. It may be advisable to provide a water tight seal around the attachment rod if it is mounted in a sleeve or a hole to avoid damage from water.

[0034] After the stationary portion 105 has been constructed, the post can be easily mounted in the field. The post 115 will typically be pre-mounted to the post base 109 painted, equipped with reflectors and otherwise prepared for service at a fabrication facility, although these operations can also be performed in the field, if desired.

[0035] In a preferred embodiment, a post 115 of PVC pipe or similar plastic pipe material is dimensioned to ensure a very tight fit over the cast iron post mount 109 so that the interfacial friction between the post and post base is sufficient to securely mount the post. The bottom end of the post 115 can be heated with a heat gun or other heat source

until it expands sufficiently to slide over the post base 109. The heated end of post 115 may then be push fit or gently pounded over the post base 109 until it is substantially flush with the bottom 117. After the post 115 has cooled and shrunk to its original size it will be very securely bonded to the post base 109. Heat fitting the post over the base eliminates the need for fasteners or adhesives and can be done quickly and easily. If a tight frictional fit is not possible, an adhesive can be applied to bond the surfaces together.

[0036] The process of field assembly begins by sliding lower bearing 106 flat side down over the attachment rod 104 so that it lies flush with mounting surface 102. Next, the post and post base are slid over attachment rod 104 followed by washer 134 and fastener 114 is threaded onto the end of attachment rod 104. Before final tightening of fastener 114, the vertical orientation of post 115 should be checked and adjusted as necessary. Once the correct orientation has been achieved fastener 114 is tightened with a lug wrench until the mounting is secure. The lug wrench will need to have a shaft that is sufficiently long to reach down through the post 115 to the fastener 114 in the post base 109. Use of a long shafted lug wrench will reduce the likelihood of tampering, theft and vandalism. For additional security, an anti-tampering fastener may be employed.

[0037] The post 115 may be equipped with reflectors, reflective strips, decals, mounting brackets or other hardware for securing markers, signs, signals, mailboxes and the like. The post installation is completed by securing a post cap 116 to the top of post 115. The cap 116 may be threaded, snapped, heat shrunk, screwed or otherwise removably fastened to the post.

[0038] In general, the break away capability of a post in embodiments of post mounts according to the present invention will depend on the post material selected. Field tests of prototypes in which post 115 was constructed from a 5 inch diameter PVC irrigation pipe demonstrated that the posts would easily break away above the post base 109 in response to a vehicular impact and that damage to both the mounting and to the vehicle was minimal.

[0039] Post realignment may be accomplished on site in a matter of minutes by removing the cap 116, loosening the fastener 114 and rotating and angularly displacing the post 115 until it is returned to an upright position. The fastener 114 may then be retightened with the long shafted lug wrench until the post is secured in the realigned position.

[0040] Should a damaged or broken post need replacement, the post or post remnant is easily removed from the base by heat expanding the plastic post material around the base. After inspecting the post base, spacer and attachment rod and repairing or replacing any of those components as needed, a new post may be heat fitted over the post base, and aligned and secured in position according to the procedures outlined above.

Conclusion

[0041] As has been shown, embodiments of the present invention provide a simple, safe, inexpensive, and easy to maintain apparatus for mounting and anchoring a post that is sufficiently strong to stand up to the elements over time, is adjustable so that the post can be reoriented to a vertical orientation after it has become misaligned, facilitates post repair and replacement and enables a post of a suitable material to break away from the mount in response to a high-force impact of a motor vehicle. A number of embodiments

of the invention defined by the following claims have been described. Nevertheless, it will be understood that various modifications to the described embodiments may be made without departing from the spirit and scope of the claimed invention. For example, in some embodiments, the lower surface of the joint may be integrated into a stationary structure so that a separate bearing component is not required. Similarly, the upper surface of the joint may be integrated into the base of a tubular plastic or metal post thus eliminating the need for a separate post base component. In other embodiments, the bearing surfaces of the joint may be formed from a lower concave mounting surface or spacer and a convex bottom post or post base. Accordingly, other embodiments are within the scope of the invention, which is limited only by the following claims.